Hybrid Heat Pipes for High Heat Flux Spacecraft Thermal Control, Phase I

Completed Technology Project (2011 - 2011)

Project Introduction

Grooved aluminum/ammonia Constant Conductance Heat Pipes (CCHPs) are the standard for thermal control in zero-gravity. Unfortunately, they are limited in terms of their heat flux capability, approximately 5W/cm2. Incident heat flux for laser diode applications is on the order of 5-10W/cm2, although this is expected to increase towards 50W/cm2. This is a severe limitation for axial groove (CCHP) as well as loop heat pipes (LHP). Standard CCHPs are also not suitable for Lunar and Martian Landers and Rovers, since they can only operate with a very small adverse elevation, on the order of 0.10 inch. Landers can have tilts of ±20

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, while rovers can have tilts of ±45

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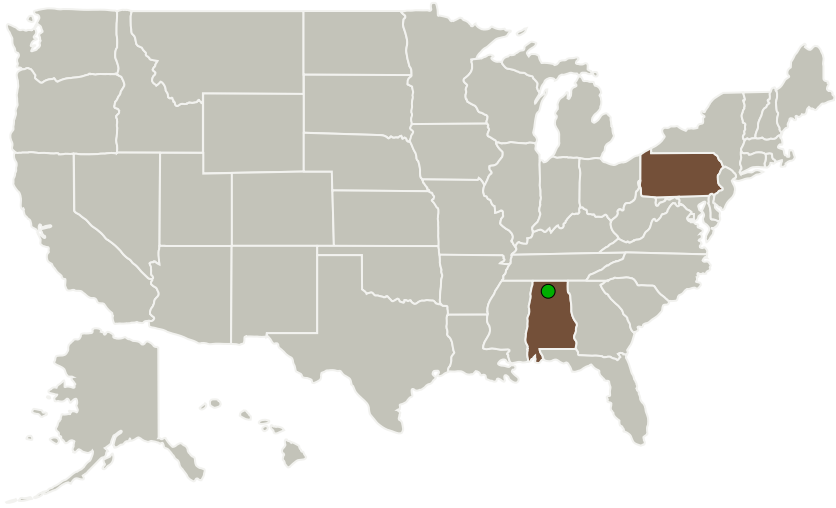
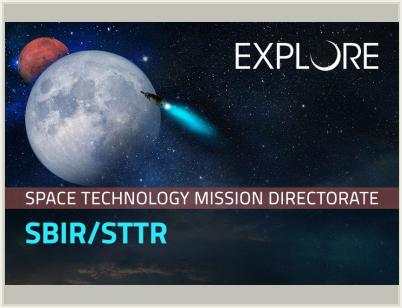
. As a result, a wick with a higher heat flux capability and pumping capability is required. This program will develop heat pipes with both 1) Sintered wicks, and 2) Hybrid grooved and sintered wicks. Heat pipes with both wick designs will be capable of operating at heat fluxes in the ten's of watts per cm2, and in Lunar or Martian environments at large slopes against gravity. An all-sintered wick will be used when the entire heat pipe must be able to operate against gravity, while a hybrid wick will be used when the condensers will always be gravity aided on the planetary surface.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Advanced Cooling Technologies, Inc.	Lead Organization	Industry	Lancaster, Pennsylvania
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Pennsylvania

Project Transitions

February 2011: Project Start

August 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138610)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Advanced Cooling Technologies, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

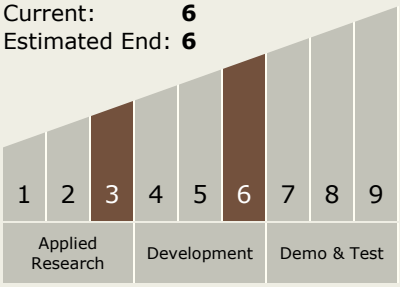
Carlos Torrez

Principal Investigator:

William Anderson

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



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Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.2 Thermal Control Components and Systems
    - TX14.2.1 Heat Acquisition

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System